

**REQUIRED OPEN ACCESS TO ETDS:  
Technical, logistical, and philosophical implications**

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**ABSTRACT**

Electronic submission of theses and dissertations has many advantages for the graduate studies office, the library, and graduate students. The open access repository that is made possible with electronic submission benefits researchers. A significant increase in positive impact occurs when an electronic submission program moves from being optional to being a requirement stated in the University's thesis regulations. While the advantages are numerous, the process of moving to required electronic submission and open access must be carried out methodically, with an eye to implications for all stakeholders. The particular focus of this paper will be on the practical experience of the University of Waterloo, where the motion to require electronic submission passed in the spring of 2006.

Keywords: electronic theses and dissertations; graduate studies; required open access; technical logistical philosophical implications

**I. EVOLUTION TO THE ELECTRONIC REQUIREMENT**

**1. Required Electronic Submission**

In 1996, when the University of Waterloo began to investigate the feasibility of electronic submission and dissemination of theses, a key motivating factor was the promise of increased access to the rich content. The potential of the Internet to disseminate information, to provide remote access, and enhance scholarly communication, was inspiring. Electronic information, searchable and remotely accessible, could bring the products of the University of Waterloo's graduate students onto the desktops of researchers around the world.

Staff from the Graduate Studies Office, the Library, and the Information Systems & Technology computing department, as well as numerous graduate students and faculty, formed the core investigation team. We saw many issues that were complex and required careful consideration. After three years we were prepared to introduce electronic submission as an option. In the fall of 1999, eight University of Waterloo graduate students submitted their theses online and authorized open access to them.

We've seen a steady increase in electronic submissions in the past seven years. We had 33 submissions in 2000. The numbers have increased each year. In 2005, nearly 35% of graduate student chose to submit online. As of May 2006 the percentage approaches 50% voluntary online submission. Nearly 600 theses are available in the local open access database.

In the progression to this phase, we faced challenges and developed solutions. Initially our policy was to require postscript as the submission format. We were concerned with long-term viability. PostScript was a well-established format and was a standard for electronic submission in the early days of electronic journals. As the PDF format grew more ubiquitous and with all but the most tech savvy students dissuaded by the PostScript requirement, the decision was made to allow PDF as a submission format. Long-term preservation concerns were alleviated by the decision to include our Masters theses as well as dissertations in Library and Archives Canada microfilm program. As the ETD submission procedures stabilized and the option grew increasingly popular, the decision was made to make the electronic submission the official university copy.

In this paper, we, all members of the Project Team, will describe to you the process of moving from an option to required electronic submission and open access. We will describe how we accomplished the change to the academic regulations. We'll describe the practical impact of the move for Graduate Studies Office workflow. We place a high priority on communications with administrators, faculty, and graduate students. Communication forums are comprehensive and ongoing. Support mechanisms are in place, Web-based as well as face-to-face, and both technical and logistical. Functional and technical specifications ensure the benefits of open access with metadata conforming to the OAI protocol for metadata harvesting.

## **2. Required Open Access**

From October 1, 2006, paper based theses are no longer be accepted by the Graduate Studies Office. All thesis submissions must be online. In coming to this crossroad, we faced issues of a philosophical nature. We've addressed questions about preservation, future access, access restrictions, alternative formatting, and inclusion of non-traditional components. We anticipate that new issues will arise and acknowledge that policies can be open to evolution. As a team, we are committed to providing strong communication channels. The communication channels in place will ensure that issues will come to light and be addressed.

Our electronically submitted theses are all, without exception, installed in our locally maintained open access database. Metadata are OAI compliant and harvested by a variety of service providers. We have no plans to provide levels of access in the database. Our students can apply for permission to have circulation of their thesis restricted for a year. Such permission is typically granted in cases where the thesis has a patent pending. Such theses will be maintained on a Graduate Studies Office server for a year before they are uploaded to the database.

The benefits of open access for authors and researchers are well documented. Previously only available on site or through purchase, theses have been a hidden wealth of valuable content. Exposure of this material can be a boon for the reputation of the university, the career and publication potential of the author, and the contribution to the advancement of scholarly communication.

## **II. GRADUATE STUDIES OFFICE**

### **1. Academic Regulations**

The Graduate Studies Office partnered with the University of Waterloo Library and Information Systems and Technology in 1996 to collaborate on issues related to access, storage, submission,

governance and philosophical issues for ETDs. The GSO focused on governance, submission and some issues related to access. Graduate students and faculty participated in the early phases of the project.

The transition from paper/bound only to voluntary electronic submission for the University copy and then required electronic submission was lengthy and involved several stages to change University regulations for degree completion and submission, and operational responsibilities of the Graduate Studies Office.

In 1999, the first proposal made to our Graduate Operations Committee (chaired by the Dean of Graduate Studies) was considered too extreme for the academic community. We proposed that electronic submission would replace all bound copy requirements. The leap from minimum bound paper copies for the University, supervisor and department to a single electronic submission requiring electronic access was modified to voluntary electronic submission of the University copy. Many departments were determined to maintain their theses libraries, and most supervisors preferred a bound copy rather than electronic access.

The central concern in the academic community was the belief that electronic theses were less significant than bound paper theses and not the accepted standard for university libraries. Over time, this concern diminished as documents such as e-journals became more accepted and archival copies of theses (microfilm or fiche) were affirmed as the standard for preservation. In addition, the limitations for all types of space continued to challenge universities.

The change to the submission regulations in 2004 was the turning point for the Graduate Studies Office. Space limitations for binding operations combined with a review to streamline and reduce activities in the office narrowed our focus on the University copy of the thesis. A recommendation to move binding operations to our graphics department was approved and allowed us to concentrate on the review of theses at the submission preparation phase, communicate the benefits of electronic thesis and increase student participation and academic interest.

Many students were supportive of the move to electronic thesis because it opened possibilities for increasing exposure to their work and accommodate the creative aspects to their thesis including colour, and the integration of enhanced objects in their theses.

Early in 2006, a proposal to require only an electronic copy of the thesis for the University was approved by the Graduate Operations Committee. The recommendation to the Senate Graduate & Research Council was a change to the graduate degree requirement of electronic submission for the University copy. Faculties would regulate bound copy requirements for their departments and supervisors.

## **2. On-line Thesis Regulations**

The GSO embraced on-line documentation beginning in the early 1990's. The [Thesis Regulations](#) and other regulatory documents including the [Graduate Studies Calendar](#), [Organization of Graduate Studies](#), [The Supervisory Process: A Guide for Faculty and Graduate Students](#) were converted for on-line use. This transition was concurrent with UW ETD project. The University community embraced this form of publication and as of 2004, only electronic documents versions were published on our web site.

The Thesis Regulations document includes format instructions and samples, information on copyright and the use of copyrighted material, completion of degree requirements and thesis submission deadlines, submission instructions, University services including courses and support for the preparation of theses, publication in microform information, and a Thesis Non-exclusive License form.

IST courses on the preparation of thesis and the availability of templates were critical to the success of the project and minimize review and submission issues for the students and the Graduate Studies Office.

### **3. Operations**

The Graduate Studies Office oversees the on-line Thesis Regulations document, reviews and approves theses prior to submission, holds theses restricted from circulation, and transmits theses to ProQuest following each University convocation. These operations are administered by a Thesis Manager.

Acceptance of the thesis by a student's thesis committee is required prior to final review and submission of the University copy. Students are sent an electronic acknowledgement confirming that their thesis meets the University requirements, or, a form identifying required changes and instructions for resubmission.

Students who wish to apply for restrictions on circulation of their thesis due to patents pending, or other circumstances, complete a [Request to Restrict Circulation of Thesis](#) form. This form must be fully approved and submitted before any restrictions will be applied to the circulation of the thesis, at least one week prior to the submission of the actual thesis for examination. Theses withheld by the GSO for a maximum of one year.

### **4. Communications**

The GSO promotes the IST courses and the University support services each term in the [Graduate Studies Newsletter](#) and in the Thesis Regulations document. In May 2006, the ETD project team invited faculty, staff and students to the first of a series of information sessions to provide information on benefits, preparation and submission of electronic thesis. These sessions were implemented to prepare students and the Graduate Studies community for the new regulation for electronic thesis effective October 2006.

### **5. Collaboration**

The continued collaboration of the UW Library, Information Systems and Technology department, and the Graduate Studies Office is key to the on-going success of electronic thesis at the University of Waterloo as regulations are refined and technology advances.

## **III. SOFTWARE ISSUES**

## **1. Thesis Creation**

The main software supported for electronic thesis preparation at the University of Waterloo is Microsoft Word. The University of Waterloo has a site license for this product. A Microsoft Word template is available for students to use as a starting point when creating their thesis in Microsoft Word.

LaTeX is available on most if not all Unix systems on campus. Students in some faculties also use other software (such as Adobe InDesign), but this ‘other software’ is generally supported by the faculty.

Microsoft Word is available on all on-campus “Nexus” labs. Our “Nexus” labs are Windows XP managed computers and all of them have Microsoft Office XP on them.

## **2. Converting to PDF**

LaTeX and Macintosh OS have built in PDF creation tools and so no special software is needed to support conversion to PDF for students using these operating systems.

The Windows applications available on campus do not have built in PDF creation tools. After investigating various options, including Active PDF (the desktop version is no longer supported and has been replaced by PrimoPDF), PDF Creator, Ghost Script, and Cute PDF, we decided to purchase a few copies of Adobe Acrobat Pro to be made available on some of our student lab (Nexus) computers on campus. We don’t have a campus-wide site license for Adobe Acrobat Pro, but we do have a Campus Licensed Program that allows us to install it on university campus computers for \$80 per machine (students can purchase it for home use for \$55 through the Adobe Student Licensing Program). We are putting it on a few student lab (Nexus) computers in each faculty and we are also installing it on some computers in our consulting offices. Once electronic thesis is the degree requirement (after September 2006) we will see if this meets our students’ needs. If necessary, we will install it on more student lab (Nexus) computers.

Reasons for choosing Adobe Acrobat Professional include: Quality of hyperlinks (being able to link to a URL from either a URL or any text); availability of bookmarks; quality of images in the PDF file; ability to optimize PDF files; and ability to merge PDF files.

Documentation related to electronic theses is available on Adobe’s site:  
<http://www.adobe.com/education/etd/tutorials.html>

## **IV. SUPPORT**

### **1. Courses**

Electronic thesis support courses offered by Information Systems and Technology (IST) include: Techniques for Managing Theses Using Microsoft Word; LaTeX Issues for Electronic Thesis Submission; and Submitting Your Thesis Online. Courses are offered at least once a term and will be offered on demand during implementation of change in regulations toward required electronic submission. Faculties and graduate student groups may also request “special request” courses for their area. Topics include: Theses Using Microsoft Word (including the use of the available Word

template); Theses using LaTeX; Equations using Microsoft Equation (with Microsoft Word); On-Line Thesis Submissions.

## 2. Online and Individual Assistance

Many of the electronic thesis course notes are available on the Web:

- Main page for preparing Electronic Thesis: <http://ist.uwaterloo.ca/ew/ethesis/ethesis.html>
- Course notes:  
<http://ist.uwaterloo.ca/ew/saw-instructional.html>
- Enhanced thesis information:  
<http://ist.uwaterloo.ca/ew/ethesis/enhanced.html>
- LaTeX notes:  
<http://ist.uwaterloo.ca/ew/ethesis/latex.html>
- Word notes:  
<http://ist.uwaterloo.ca/ew/thesis/ThesisCourse/WordTheses.html>
- Word tips for electronic thesis:  
<http://ist.uwaterloo.ca/ew/ethesis/wordtips.html>
- Images in your thesis:  
<http://ist.uwaterloo.ca/ew/ethesis/images.html>  
<http://ist.uwaterloo.ca/ew/ethesis/pastein.html>
- Special characters in your abstract: <http://ist.uwaterloo.ca/ew/ethesis/specchar.html>
- Creating your PDF file:  
<http://ist.uwaterloo.ca/ew/ethesis/createpdf.html>
- On-Line Thesis Submissions:  
<http://ist.uwaterloo.ca/ew/ethesis/uploading.html>

Our Computing Help and Information Place (CHIP) staff are available to help with PDF conversion from Windows applications

Staff in Client Services, Information Systems and Technology, are available to help with electronic theses created in Word, PDF creation from Windows applications, electronic theses created in LaTeX, and other general questions. Faculty helpdesks are able to provide technical support.

The Library provides support with enhanced thesis, uploading, and maintenance issues. The Graduate Studies Office provides guidance, information about courses and useful web pages (which provide information and instructions) and may provide access to Adobe Acrobat Professional for students in their office.

## V. SYSTEMS SPECIFICATIONS

### 1. Functional

The primary guideline for the development of the technical portion of the electronic thesis submission program at the University of Waterloo was to make the system self-sustaining. The

idea was to avoid the introduction of a new workload and materials handling stream into an already busy technical services operation. Students would be made responsible for the creation of their own metadata records and almost all other aspects of the submission process. The system would have to be Web-based to allow record creation and thesis submission from anywhere on the Internet. Students sometimes do not submit the final version of their theses until long after they have left the campus.

Only valid University of Waterloo students would have access to the metadata record creation and thesis submission process so an authentication method was required. It was also recognized that students would probably wish to edit and re-edit their metadata record any number of times right up until the moment of final acceptance. Similarly students would need the ability to submit and resubmit their electronic theses with changes either requested by the Graduate Office or to correct errors discovered in the document. Since multimedia was recognized as one of the enhancement potentials of the submission of the electronic theses, the system was also required to handle the submission of multipart items. Access to the metadata record for adjustment and the resubmission of the actual thesis should be allowed right up until the official acceptance of the thesis. Once accepted by the department the metadata record can no longer be adjusted and the submission of revised copies of the thesis is prevented.

## **2. Technical**

The University of Waterloo's electronic thesis submission program was developed using Macromedia's ColdFusion with a Microsoft SQL Server backend. Separate servers are used for the ColdFusion supplemented Web server and the database server. The electronic thesis program is one of many Web services provided by the University of Waterloo Library that is handled by these servers.

The Library is currently exploring the use of DSpace from MIT to operate an Institutional Repository. This is Open Source software which should allow the addition of any capabilities required to duplicate the service of our current submission system.

## **3. Metadata Record Creation and Thesis Submission**

To access the electronic thesis submission process, students must authenticate themselves against UWDir, the University of Waterloo's LDAP server. Once authenticated, if it is the student's first access to the submission process, they are presented with a metadata submission form. The metadata submission form is used to collect author identification information and basic bibliographic information describing the theses.

The Waterloo user ID, collected during the authentication process and matching the student's unique account in the University's LDAP Directory, is used in the construction of file and directory names in combination with the year of submission (e.g. ktchan2005.pdf).

Students are asked to enter only ASCII data in the record. Any required special characters are created using HTML tags. A link to a table of iso8859-1 entity references is included in the instruction [6]. Links to a help page popup are provided for each field to assist the student to correctly complete the form. Input data is verified wherever possible. The student ID number, for example, is checked to ensure that it is numeric. All essential fields are indicated on the

submission form and a record cannot be submitted until all these fields have been completed. Drop down selection boxes for department, degree, year and language are used to ensure consistent input of common data. For the year of submission the system automatically generates the previous, current and three future years for selection. This avoids having to update the form annually.

If the student has already submitted a record and the thesis has not yet been officially accepted, its status is “Temporary”. Students can enter their ID numbers to get access for editing the metadata or submitting or re-submitting their theses. When a metadata record is entered or adjusted by a student the record is displayed for proofreading in the format that it will appear when the record is available for public access. Hidden fields appear in a list at the bottom of the display for verification. Once confirmed, the metadata record is written to the database with a “Temporary” status assigned that remains until the thesis is accepted officially. The student may access the records as many times as required up until acceptance of the thesis is official. The graduate studies office notifies the library that the thesis is officially accepted. Library staff moves the file to the permanent ETD server and use the administrative module to change the status of the metadata record to “Accepted”.

An administrative module allows access to submitted records. Records may be edited, deleted or have their status changed from "Temporary" to "Accepted" or “Pending”. An "Accepted" status triggers the record for public display and closes off access for further editing to the student. A record with “Pending” status (for example in cases where a patent is pending) will be updated to “Accepted” after a period of time, normally within a year.

The use of popup help pages for each field in the submission form, drop down selection menus, required field alerts and input verification JavaScripts where possible, are all designed to achieve the objective of a self-sustaining system.

## **VI. ACCESS**

### **1. Public Interface**

Once a thesis has been accepted, it is added to the ETD server for public access. The URL pointing to the ETD Server is generated automatically by the system constructing the file name from the UW user ID and the year of submission. When the status of the metadata record is set to "Accepted" it is immediately available for public access.

The public display provides access to the thesis database. A quick search provides an All Fields, Subject Keywords (which includes assigned subject terms as well as keywords added by the student), Author, Title and Year search options. A program search drop down selection menu, including only those programs with at least one submitted electronic thesis, returns all records submitted to the program. All search methods return a brief display of records with links to a full record display. The full display minus hidden fields is identical to that used by the student to proofread their records. An automatically constructed URL points a user to the complete PDF version of the theses on the ETD Server.

The objective of creating a self-sustaining submission program with minimal maintenance has been achieved. Students perform almost all the tasks required for the submission program. Aside from the evaluation of the theses, its placement on the ETD server after acceptance and the



setting of the record status to 'Accepted', no other administrative effort is required for the system to operate.

## **2. Dissemination of Metadata**

An OAI-PMH module was developed. Records can be retrieved in Dublin Core or oai\_etdms: format. Waterloo's records are available for harvesting and are currently being harvested by Theses Canada, the ETD Union Catalog of the Networked Digital Library of Theses and Dissertations, and the CARL (Canadian Association of Research Libraries) Institutional Repositories Harvester.

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9<sup>th</sup> International Symposium on Electronic Theses and Dissertations  
IX<sup>e</sup> Symposium international sur les thèses et mémoires électroniques  
June 7 – 10 Juin, 2006, Quebec City / Québec, Canada

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